REMARKS/ARGUMENTS

In response to the Office Action mailed August 24, 2005, Applicants amend their application and request reconsideration. In this Amendment, claims 1-4 are cancelled leaving claims 5-8 pending.

The invention concerns a spiral inductor, particularly useful in a semiconductor device structure where it is difficult to form inductors with useful inductances. Further, as defined by claims 7 and 8, the invention concerns transformers incorporating the spiral inductors.

The spiral inductors that are the subject of the claims include numerous parts. An important part is a planar continuous spiral interconnect, embodiments of which are illustrated in numerous figures of the patent application. Perhaps the embodiments are most easily understood with regard to Figures 3 and 4. The spiral interconnect in those figures is the element 50. The spiral interconnect there includes turns that have square corners and that extend between two ends, an internal end that is inside the spiral turns and an external end that is outside the spiral turns. In other embodiments of the invention illustrated in the patent application, the spiral turns may be generally polygonal, see Figures 10 and 11, or be free of corners, see the embodiment of Figures 8 and 10.

The spiral inductor according to claim 5 includes a first underpass interconnect which is illustrated by element 10 of the exploded view of the embodiment illustrated in Figure 4. The element 30 shown in that figure is inverted when placed upon the element 40c to form the underpass interconnect illustrated in the assembly of Figure 3. That first underpass interconnect is connected to the unnumbered internal end of the spiral interconnect of Figure 3. Similarly, a like underpass interconnect is connected to an internal end of a spiral interconnect according to embodiments of the invention clearly illustrated in Figures 7, 9, and 11. Contact plugs provide electrical interconnections between the continuous spiral interconnect and other electrically conductive layers of the structure and are also part of the first underpass interconnect that provides electrical access from outside the spiral interconnect to the internal end of the spiral interconnect. Examples of those plugs are illustrated most clearly in the embodiment of Figure 4 of the patent application as elements 60 and 70.

An important feature of the invention is that the turns of the spiral interconnect that are opposite the first underpass interconnect, i.e., where the first underpass interconnect crosses the turns, are wider than other parts of the turns of the spiral interconnect. This difference in width of the turns is illustrated in Figure 3, although somewhat subtle in that view. Like arrangements are illustrated in the embodiments of Figures 7, 9, and 11 of the patent application. In Figure 11, the first underpass interconnect 11 is also indicated with the letter Y.

The spiral inductor according to claim 6 further includes a second of these underpass interconnects. That second underpass interconnect is not connected to an end of the spiral interconnect but to an intermediate point of the spiral interconnect, at one of the turns intermediate the internal and external ends of the spiral interconnect. Figures 10 and 11 illustrate one embodiment of a structure falling within the scope of claim 6 in which the second underpass interconnect is element 12 and also indicated with the letter Z. It is apparent that where that second underpass interconnect crosses an outer turn of the spiral interconnect that the outer turn is wider than parts of the turns of the spiral interconnect that are not opposite an underpass interconnect. As observable from the embodiment of Figure 10, the turns are also relatively wide where the first underpass interconnect 11 passes beneath the turns. That first underpass interconnect is connected to the internal end of the spiral interconnect.

As explained at pages 10 and 11 of the patent application, the reason for the differences in widths of particular elements of the claimed spiral inductor is to reduce, at those wider locations, current density and thereby avoid the problem of electromigration. It is well known in the art of integrated circuits, to which the claimed inductors readily apply, that high current densities flowing through electrical conductors can actually cause movement of atoms of the metal of the conductors. This phenomenon is known as electromigration and can result in the electrical opening of a conducting path in a conductor if sufficient material is actually transported from one location to another. Likewise, the wider structures reduce parasitic capacitances which can be of particular importance when the invention is applied to MMIC's (monolithic microwave integrated circuits).

In the foregoing amendment, claims 5 and 6 have been clarified and corrected to be consistent with the disclosure of the patent application and each other. No substantive

amendment has been intentionally made. Rather, these amendments only are intended to correct inartful descriptions of what is disclosed in the patent application.

All examined claims were rejected as anticipated by Lowther et al. (U.S. Patent Publication 2003/0127686, hereinafter Lowther). This rejection is respectfully traversed.

In order to anticipate a claim, a prior art publication must disclose every limitation of the claim. Lowther fails to disclose limitations of the claims presented for examination and clearly fails to anticipate any claim now pending because of numerous differences between the claims and what is described by Lowther. Lowther basically describes various inductors and transformers that include, only in the most general sense, spiral windings because of crossover interconnections between windings that are fundamentally concentric. As a result of the crossover interconnections in Lowther, there is no spiral interconnect structure disposed in a single layer and that is essentially planar in the structures described by Lowther. Further, there are no first and second underpass interconnect structures in Lowther as in the claimed invention.

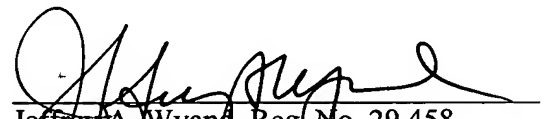
The first interconnect structure of the invention, as described in the clarified claims, provides a connection to the internal end of the spiral interconnect. There is, essentially, no internal end and no external end in most of the embodiments described by Lowther. In the embodiment of Figure 9 of Lowther, there appears to be an internal end of a winding connected to what might be compared to the first underpass interconnect of claim 5, identified as element 266. It is apparent that where that element 266 crosses the turns of Lowther's spiral windings, that the spiral windings have the same width as elsewhere, failing to meet the requirement of claims 5-8. It might be argued by the Examiner that, at the multilayer interconnection 256 closest to the connection 266, the turn of the spiral interconnect is narrower than elsewhere, meeting the limitation of claim 5. However, that turn in Lowther is not a turn to which the interconnection 266 is connected. Figure 9 of Lowther illustrates a transformer with two separate spiral windings. Even if the width of the turns of the conductor 245b at the multilayer interconnection 258 is considered, then it is apparent that the spiral is not planar, as is the spiral interconnect of the invention, because of the interconnect 256 of Lowther. The same analysis applies with respect to the other embodiments described by Lowther, showing that there can be no anticipation of claim 5 by any disclosure in Lowther.

In addition, the rejection is erroneous because the Examiner has twice cited the same elements of Lowther as meeting different limitations of the examined claims. For example, at page 5 of the Office Action, element 132 of Lowther is counted as both the first underpass interconnect and the second underpass interconnect. In fact, only a single such interconnect is illustrated in the cited figures of Lowther so that the application of Lowther to at least claims 6 and 8 is clearly legally and factually incorrect. Moreover, with respect to the figures including the reference numbers cited by the Examiner, contrary to the Office Action, there is no internal end of any spiral interconnect. For example, in Figure 1A of Lowther, because of the non-planar interconnect appearing at the right side of that figure, both of the ends of the spiral inductor are external ends, outside of the spiral interconnect. Further, with respect to that figure of Lowther and claims 6 and 8, there is no element in Lowther that can correspond to the second underpass interconnect. The only "center tap" of the winding in Lowther's Figure 1A, element 110, never crosses any turn of the spiral interconnect. See also the structure of Figure 6 of Lowther. None of the other Lowther structures includes any intermediate tap that could be possibly compared to the second underpass interconnect of claim 6. Therefore, claims 6 and 8 are clearly patentable over Lowther, independent of the patentability of claim 5.

Claims 7 and 8 are clearly patentable over Lowther because of their incorporation of claims 5 and 6, respectively.

For the foregoing reasons, no claim now pending can be anticipated by Lowther so that, upon reconsideration, the rejection should be withdrawn and the remaining claims allowed.

Respectfully submitted,



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